

**Washington.**—The mean temperature was  $41.7^{\circ}$ , or about normal; the highest was  $71^{\circ}$ , at Hooper on the 31st, and the lowest,  $13^{\circ}$ , at Usk on the 17th. The average precipitation was 3.72, or 0.59 above normal; the greatest monthly amount, 17.28, occurred at Clearwater, and the least, 0.03, at Pasco.

Fore part of month warm, latter part cool, with frosts; spring backward, but, on that account, is thought favorable for fruit. Ground too wet for working in western section, but plowing and wheat seeding progressed steadily in eastern section. Condition of winter wheat improved; much had to be resown.—*G. N. Salisbury.*

**West Virginia.**—The mean temperature was  $43.4^{\circ}$ , or  $1.1^{\circ}$  above normal; the highest was  $80^{\circ}$ , at Logan on the 11th, and the lowest,  $5^{\circ}$  below zero, at Camden on the 6th. The average precipitation was 4.30, or 0.31 above normal; the greatest monthly amount, 6.29, occurred at Williamson, and the least, 3.00, at Central Station.

Practically no farm work done until the fourth week, which was mild and pleasant. Winter wheat, rye, and oats generally below average condition, with prospect for not more than half a crop; some wheat and fall-sown grass winter-killed; fruit buds swelling and prospects excellent, except for peaches.—*E. C. Vose.*

**Wisconsin.**—The mean temperature was  $36.0^{\circ}$ , or  $8.2^{\circ}$  above normal;

the highest was  $75^{\circ}$ , at Knapp on the 26th, and the lowest,  $10^{\circ}$  below zero, at Hayward on the 17th and at Butternut on the 18th. The average precipitation was 1.33, or 0.60 below normal; the greatest monthly amount, 2.65, occurred at Green Bay, and the least, 0.20, at Antigo.

The month as a whole was remarkably warm, especially during the first and third decades. Considerable seeding was done during the latter part of the month, with the soil in very good condition. Winter grains are almost universally reported in good condition, but clover and meadows generally are only fair.—*W. M. Wilson.*

**Wyoming.**—The mean temperature was  $30.7^{\circ}$ , or  $1.5^{\circ}$  above normal; the highest was  $85^{\circ}$ , at Rock Springs on the 14th, and the lowest,  $19^{\circ}$  below zero, at Daniel on the 3d. The average precipitation was 0.99, or 0.33 below normal; the greatest monthly amount, 2.46, occurred at Fort Yellowstone, and the least, trace, at Lovell (Byron P. O.).

The month was quite favorable for stock, although some of the cold storms were trying on both sheep and cattle. The stock losses for the winter have been very light and stock is now in good condition over most sections of the State. Some plowing in Big Horn and the eastern counties and in a few of the earlier sections some seeding was done.—*W. S. Palmer.*

## SPECIAL CONTRIBUTIONS.

### RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

*Scientific American.* New York. Vol. 86.

Trowbridge, John. Lightning above and below Water. P. 239.

*Scientific American Supplement.* New York. Vol. 53.

— The Inert Constituents of the Atmosphere. Pp. 21950-51.

*Journal of the Franklin Institute.* Philadelphia. Vol. 153.

— Subterranean temperature. P. 284.

Watts, Harvey M. The Mechanism and Causation of Hot Waves. Pp. 285-293.

*National Geographic Magazine.* New York. Vol. 13.

Henry, Alfred J. The Storm of February 25-28, 1902. Pp. 110-112.

*London, Edinburgh, and Dublin Philosophical Magazine.* London. 6th Ser. Vol. 3.

Kelvin, Lord. Aepinus Atomized. Pp. 257-283.

McClung, R. K. The Rate of Recombination of Ions in Gases under Different Pressure. Pp. 283-305.

Donnan, F. G. Condensation of the Vapours of Organic Liquids in Presence of Dust-free Air. Pp. 305-310.

Wade, E. B. H. A new Hygrometric Method. Pp. 380-385.

Rayleigh, Lord. On the Question of Hydrogen in the Atmosphere. Pp. 416-423.

*Science.* New York. Vol. 15.

Bigelow, Frank H. A New Barometry for the United States, Canada, and the West Indies. Pp. 417-421.

Ward, R. DeC. Mauritius Meteorological Society. Pp. 435-436.

Ward, R. DeC. Day Darkness in London. [Note on article by J. E. Clark.] P. 437.

Ward, R. DeC. Climatic Conditions of Panama and Nicaragua. [Note on article by H. L. Abbot.] P. 436-437.

Ward, R. DeC. Climatic Conditions of Panama and Nicaragua. [Note on article by H. L. Abbot.] P. 436-437.

Ward, R. DeC. "British Rainfall." P. 436.

Bradley, W. P. A very sensitive Thermostat. Pp. 510-511.

White, Horace. Scientific Nomenclature. P. 511.

Ward, R. DeC. The Dust Storm of March 9-12, 1901. [Note on monograph by Hellmann and Meinardus.] Pp. 555-556.

Ward, R. DeC. Meteorological Chart of the Great Lakes. [Note on chart by A. J. Henry and N. B. Conger.] P. 556.

Ward, R. DeC. The Seismograph as a Sensitive Barometer. [Note on article by F. Napier Denison.] Pp. 556-557.

Ward, R. DeC. Fog in Switzerland. [Note on Report by Gottfried Streun.] P. 594.

Ward, R. DeC. [Note on] Hail Prevention. Pp. 594-595.

*Nature.* London. Vol. 65.

Reid, Clement. The Recent Fall of Red Dust. P. 414.

Halm, J. On Professor Arrhenius' Theory of Cometary Tails and Aurora. Pp. 415-416.

Maclear, J. P. The Zodiacal Light. P. 416.

Graham, W. H., and Stoney G. Johnstone. Sun Pillars. Pp. 465-466.

Mallock, A. Rotation of a Lamina Falling in Air. P. 510.

Paul, G. Sun Pillars. Pp. 511-512.

Russell, R. Sun Pillars. P. 512.

Herschel, W. J. Sun Pillars. P. 512.

Stevens, Catherine O. Sun Pillars. P. 512.

— The Exploration of the Atmosphere at Sea by means of Kites. P. 545.

*Popular Science Monthly.* New York. Vol. 60.

Bigelow, Frank H. The Formation and Motions of Clouds. Pp. 495-502.

Dexter, Edwin Grant. A Study of Calms. Pp. 521-527.

*Journal of the Scottish Meteorological Society.* London. 3d Ser. Vol. 12.

Buchan, Alexander. Fogs on the Coasts of Scotland. Pp. 3-12.

Buchan, Alexander. Storms on the Coasts of Scotland. Pp. 12-20.

Rankin, Angus. Note on the Number of Gales at the Ben Nevis Observatory. Pp. 20-22.

*Bulletin of the American Geographical Society.* New York. Vol. 34.

Brownlie, Alexander. The Tides in the midst of the Pacific Ocean. P. 17-25.

*Geographical Journal.* London. Vol. 19.

Mill, Hugh Robert. Oceanographical Research in the Atlantic. Pp. 354-359.

*Proceedings of the Royal Society.* London. Vol. 69.

Crookes, William. Radio-activity and the Electron Theory. Pp. 413-422.

*Symons's Meteorological Magazine.* London. Vol. 37.

— The Cold February of 1902. Pp. 17-20.

*Terrestrial Magnetism.* Baltimore. Vol. 7.

Littlehales, G. W. Forthcoming Advances in the Terrestrial Magnetism of Antarctica. Pp. 1-9.

Elster, J. Messungen des elektrischen Potentialgefälles auf Spitzbergen und Juist. Pp. 9-15.

Bauer, L. A. Report on the Magnetic Observations made in North America during the Total Solar Eclipse of May 17-18, 1901. Pp. 16-23.

Moidrey, J. de. Magnetic Observations made at the Magnetic Observatory, Zi-Ka-Wei, China, during partial Solar Eclipse, November 11, 1901. Pp. 23-26.

*Journal of Physical Chemistry.* Ithaca. Vol. 6.

Geer, William C. Thermostats and Thermoregulators. Pp. 85-105.

Bradley, W. P., and Browne, A. W. A Thermostat sensitive to a Thousandth of a Degree.

*Comptes Rendus de l'Academie des Sciences.* Paris. Tome 134.

Sebillaut, —. Sur une chute de pluie observée à Périers. (Manche). P. 324-325.

Guillaume, J. Observations du soleil faites à l'observatoire de Lyon (Équatorial Brünner de 0.16 mètre) pendant le troisième trimestre de 1901. Pp. 583-585.

Nordmann, Charles. Théorie électromagnétique des aurores bo-

- réales et des variations et perturbations du magnétisme terrestre. Pp. 591-594.
- Deslandres, H. et Décombe.** — Sur la recherche d'un rayonnement Hertzien émané du soleil. Pp. 527-530.
- André, G.** Action de la température sur l'absorption minérale chez les plantes étoilées. Pp. 668-671.
- Le Cadet, G.** Dispositif d'électroscopie atmosphérique enregistreur. Pp. 745-747.
- La Nature. Paris.** 50me Année.
- Marty, G.** Régulateurs de température et d'humidité. Pp. 196-198.
- Y., —. La résistance de l'air et la loi de Duchemin. Pp. 210-211.
- Rabot, Charles.** Les pluies de poussière et les glaciers. Pp. 259-260.
- Annuaire de la Société Météorologique de France. Paris.** 50me Année.
- Lemoine, Georges.** Étude sur l'hydrologie du Bassin de la Dordogne. Pp. 25-42.
- Moureaux, Th.** De l'influence des courants "vagabonds" sur le champ magnétique terrestre à l'observatoire du Parc Saint-Maur. Pp. 42-46.
- Ciel et Terre. Bruxelles.** 22me Année.
- Arctowski, Henryk.** Nuages lumineux et nuages irisés. Pp. 17-21.
- Vanderlinde, E.** Observations sur la hauteur de neige lors du dernier dégel. Pp. 26-27.
- Very, F. W.** Un cycle cosmique. Pp. 59-68.
- Arctowski, Henryk.** Note sur les phénomènes crépusculaires observés à bord de la "Belgica." Pp. 68-79.
- L'Aérophile. Paris.** 10me Année.
- La Vaulx, Henry de.** Expérience d'aéronautique sur la Méditerranée. Le voyage du "Méditerranéen." Pp. 39-44.
- La Vaulx, Henry de.** Le voyage du "Méditerranéen." Pp. 53-58.
- Roze, Louis.** L'aviateur Roze et ses conséquences dans l'avenir de navigation aérienne. Pp. 65-71.
- Annales de Géographie. Paris.** 11me Année.
- Passerat, C.** Essai d'une carte de la répartition des jours de gelée en France. Pp. 111-116.
- Annales de Chimie et de Physique. Paris.** 7me Série. Tome 25.
- Raulin, V.** Variation séculaire du magnétisme terrestre. Pp. 289-308.
- Berthelot, —.** Recherches sur quelques effets de l'insolation sur les plantes et sur le raisin en particulier. Pp. 433-452.
- Archives des Sciences Physiques et Naturelles. Genève.** Tome 13.
- Elster, J. et Geitel, H.** Recherches sur la radioactivité induite par l'air atmosphérique. Pp. 113-129.
- Gautier, R.** Résumé météorologique de l'année 1900 pour Genève et le Grand Saint-Bernard. Pp. 148-181.
- Journal de Physique. Paris.** 4me Série. Tome 1.
- Bouty, E.** Einige Bemerkungen zur Absorption der Erdstrahlung durch die atmosphärische Kohlensäure. [Note on article by Knut Angström.] P. 167.
- Sagnac, G.** Recherches sur le bleu du ciel. [Note on memoir by Giuseppe Zettwuch.] Pp. 239-240.
- Baillaud, Jules.** Atmospheric radiation. [Note on memoir by Frank W. Very.] Pp. 240-243.
- Das Wetter. Berlin.** 9 Jahrgang.
- Assmann, Richard.** Die meteorologischen Verhältnisse während der Todesfahrt des Hauptmanns von Sigsfeld am 1. Februar 1902. Pp. 25-32.
- Grohmann, —.** Die klimatischen Verhältnisse des Königreiches Sachsen in ihrer Abhängigkeit von Luftdruck und Windursprung. Pp. 32-40.
- Assmann, Julius, Sr.** Die atmosphärischen Begleiterscheinungen des Gewitters vom 2 Januar 1902. Pp. 41-42.
- Brennecke, W.** Sylvester auf dem Brocken. Pp. 43-45.
- Sieberg, A.** Ein Beispiel für die Wirbelbewegungen in Cumulus-Wolken. Pp. 49-53.
- Grohmann, —.** Die klimatischen Verhältnisse des Königreiches Sachsen in ihrer Abhängigkeit von Luftdruck und Windursprung. Pp. 53-64.
- Winterliches Gewitter. Pp. 67-68.
- Brennecke, W.** Bestimmung der Schneehöhe auf dem Brocken. P. 69.
- Physikalische Zeitschrift. Leipzig.** 3 Jahrgang.
- Lecher, E.** Ueber drahtlose Telegraphie. Pp. 273-274.
- Gaea. Leipzig.** 38 Jahrgang.
- Eine neue Theorie zur Erklärung der periodischen Erscheinungen auf der Sonne. P. 205-217.
- Klimatologische Mittelwerte für ganze Breitenkreise. Pp. 219-224.
- Die Abnahme der Temperatur innerhalb der Gebiete hohen und niedrigen Luftdrucks. P. 314.
- Annalen der Hydrographie und Maritimen Meteorologie. Hamburg.** 12 Jahrgang.
- Dinklage, L. E.** Orkan im östlichen Theile des nordatlantischen Passatgebietes im September 1900. P. 148-149.
- Annalen der Physik. Leipzig. Vierter Folge. Band 7.**
- Toepfer, Max.** Grenzpotentialdifferenzen der elektrischen Entladung in Luft von Atmosphärendruck. Pp. 477-493.
- Quincke, G.** Ueber unsichtbare Flüssigkeitsschichten und die Oberflächenspannung flüssiger Niederschläge bei Niederschlagsmembranen, Zellen, Colloiden und Gallerten. P. 631-683.
- Meteorologische Zeitschrift. Wien.** Band 19.
- Bjerknes, V.** Cirkulation relativ zu der Erde. Pp. 97-108.
- Draenert, F. M.** Das Klima von Juiz de Fora im Staate Minas-Geraes. Pp. 108-119.
- M. Guldberg. P. 119.
- Sir Henry Gilbert. P. 119.
- Der erste vollständige Jahrgang meteorologischer Beobachtungen auf der Zugspitze. P. 119-120.
- Hann, J.** Klima von Konstantinopel. Pp. 120-123.
- Hann, J.** Zur Meteorologie von Peru. Pp. 123-128.
- Leonhard, —.** Klima der Insel Kythera. Pp. 128-131.
- Hann, J.** Klima von Asuncion, Paraguay. Pp. 131-133.
- Lenard, P.** Ueber die Elektricitätszerstreunung in ultraviolett durchstrahlter Luft. Pp. 133-135.
- Erk, F.** Die telegraphische Verbreitung der Wettervorhersage in Bayern. Pp. 135-136.
- Hann, J.** Der jährliche Gang der Temperatur-Unterschiede zwischen den beiden meteorologischen Stationen in Catania (Universität und Astrophysikalischen Institut.) P. 136.
- Trabert, W.** Die Korrektion der Registrirapparate wegen Trägheit. Pp. 136-139.
- Memorie della Società degli Spettroscopisti Italiani. Catania.** Vol. 31.
- Mazzarella, U.** Osservazioni della "Rain-Band" fatte nel R. Osservatorio di Catania nell' anno 1899. Pp. 23-35.
- Bulletino Mensuale. Società Meteorologica Italiana. Torino.** Ser. 2. Vol. 21.
- Passerini, N.** Sopra la pioggia melmosa (pioggia di sangue), caduta in Firenze, la sera del maggio 1901. P. 33-40.
- Boletín del Instituto Físico-Geográfico de Costa Rica. San José.** No. 13. 1902.
- Pittier, Enrique.** Experimentos de aclimatacion en los repastos del volcán de Turrialba. Pp. 1-6.

#### STUDIES ON THE STATICS AND KINEMATICS OF THE ATMOSPHERE IN THE UNITED STATES.

By Prof. FRANK H. BIGELOW.

#### III.—THE OBSERVED CIRCULATION OF THE ATMOSPHERE IN THE HIGH AND LOW AREAS.

##### GENERAL DESCRIPTION OF THE VECTORS OBTAINED BY OBSERVATION.

In my original report on the cloud observations of 1896-97, it was necessary to present the data in such a form that other students could have the facts at first hand. As then pointed out there are several subareas in which only a few observations were located, and they are quite unevenly distributed about the central axis, so that the final vectors as computed do not have the well-balanced smoothness which it is desirable to obtain. The data was given in the form of tabulations and also of diagrams, since it is easier to secure from the latter a clear mental picture of the average configuration of the vectors of motion in all parts of the cyclones and anticyclones. Having done this at the outset I now proceed to draw up an average system of vectors by the process of graphic adjustment. There will still remain some uncertainty as to the finer details in certain areas where the motion is more complicated, but I am quite sure that the results presented in this paper give a very correct idea of the mean motions of the atmosphere over the United States and Canada. It would require a good deal more labor in observation and computation than was involved in a single year's campaign to bring the work to that degree of perfection which is desired by meteorologists; this work must undoubtedly be expended in the interest of science some time in the future. Especially for the higher strata of the high and low areas do we need more observations, because the powerful eastward drift quickly obscures the comparatively small gyroscopic components that penetrate up to the high levels. It should be remembered that the vectors in hand were procured by observing the motions of the air almost daily throughout the year, and consequently that all kinds of weather have entered our final results. If we want the characteristic circulation pertaining to well developed cyclonic and anticyclonic